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Cleaning apparatus

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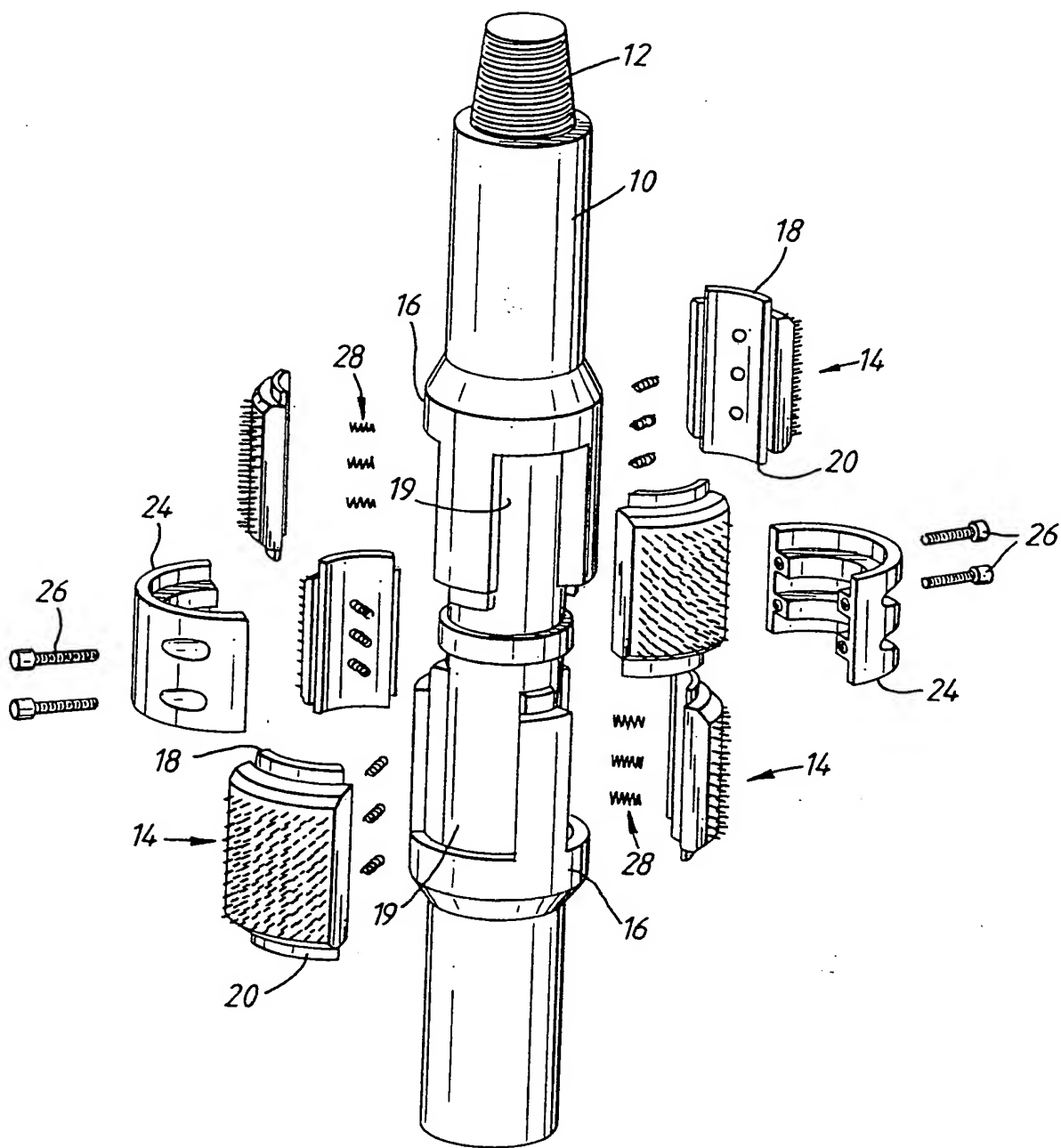


Fig.1

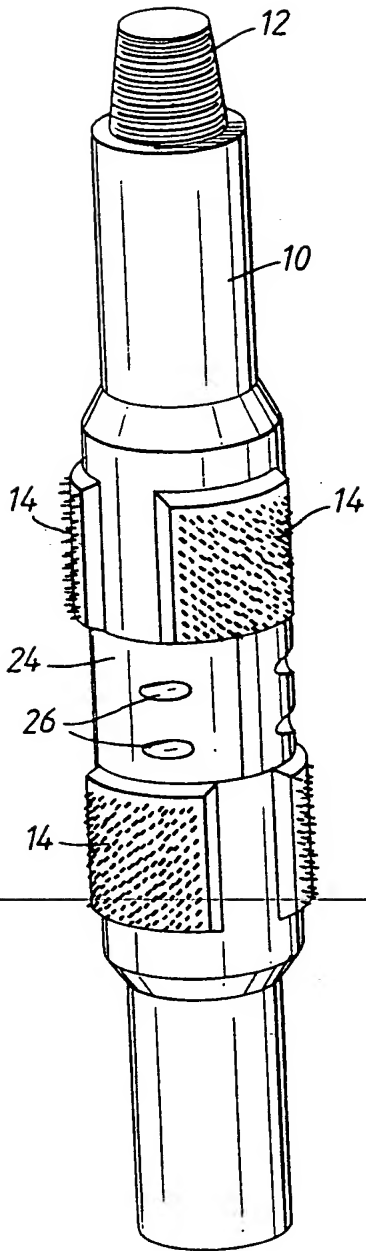


Fig. 2

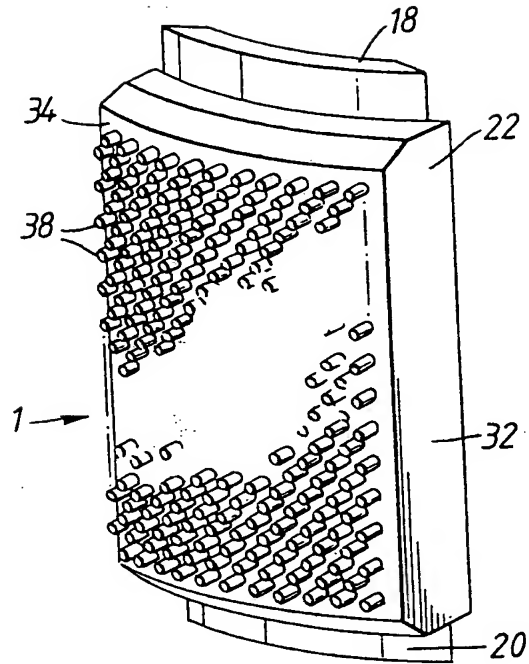


Fig. 3

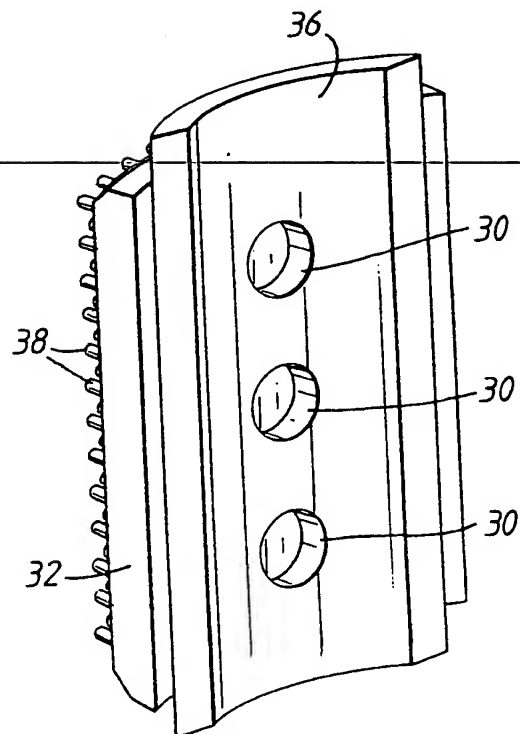


Fig. 4

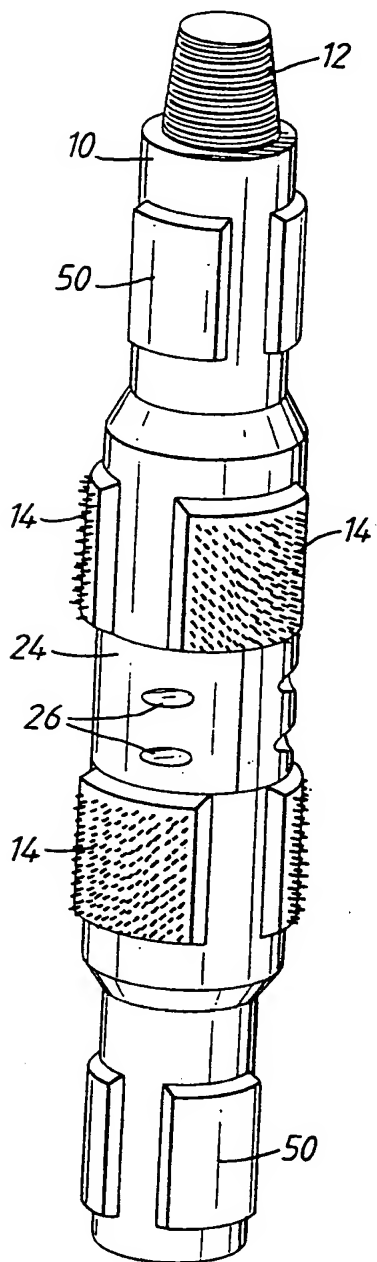


Fig. 5

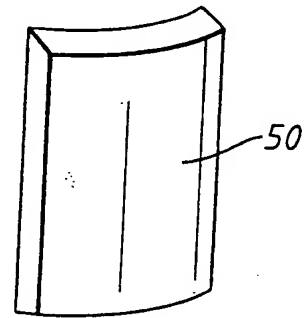


Fig. 6

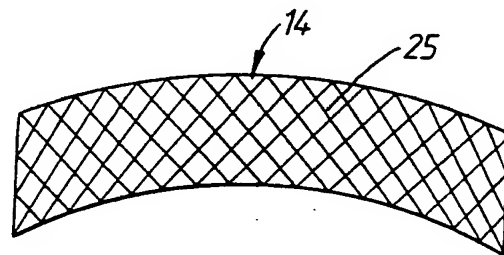
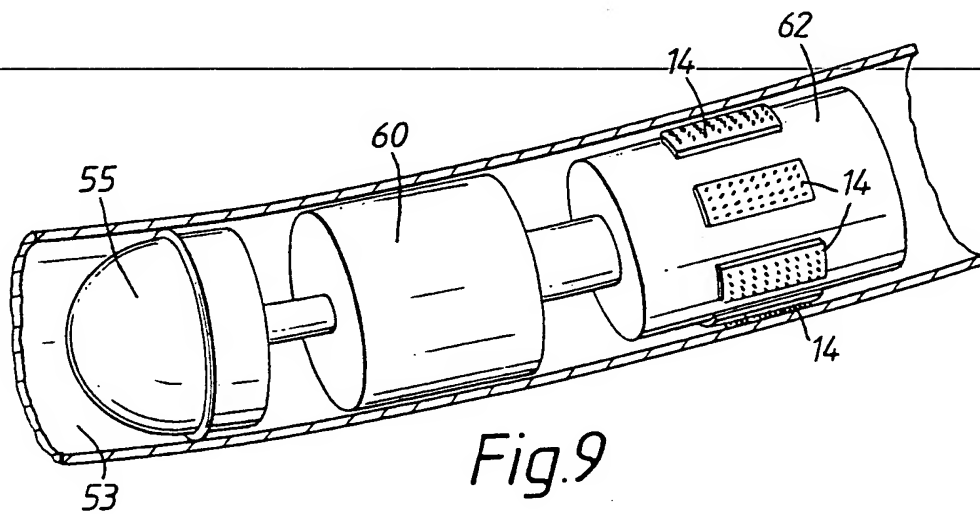
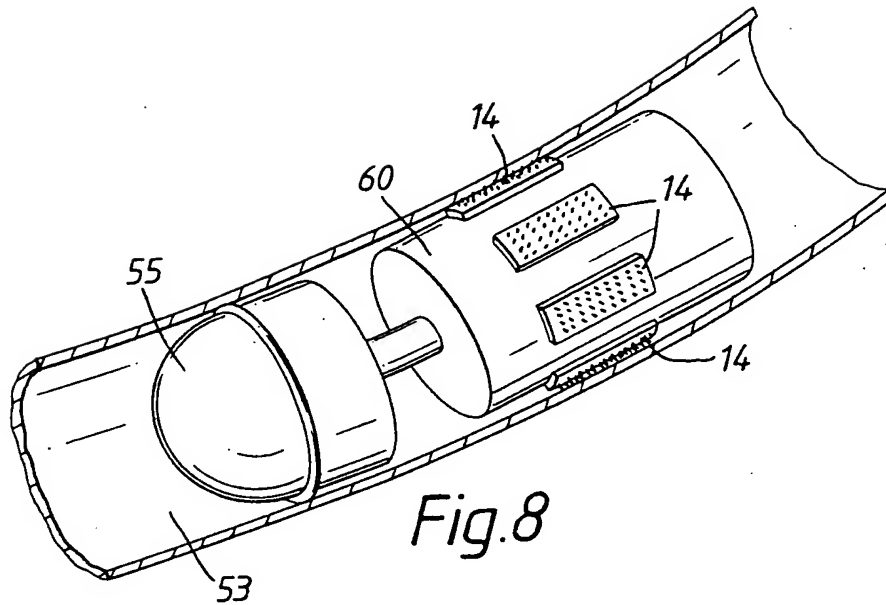


Fig. 7

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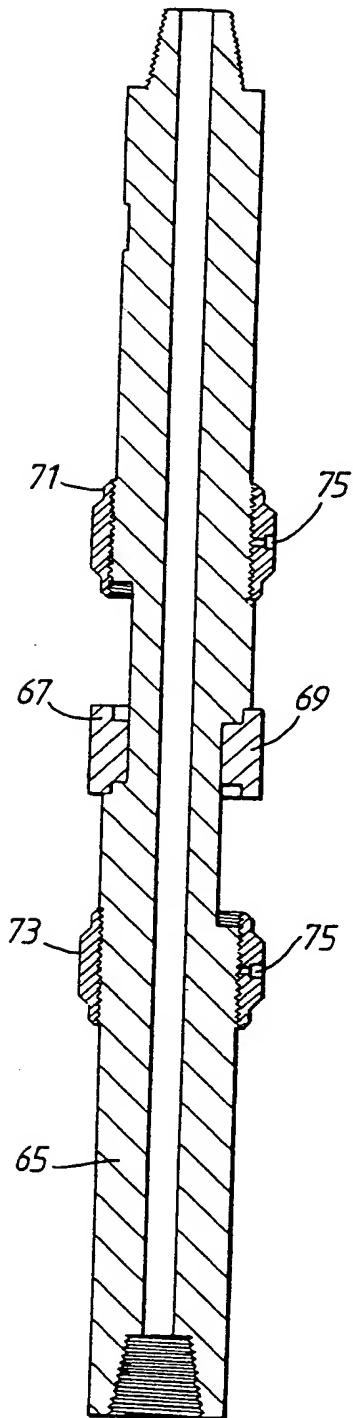


Fig.10

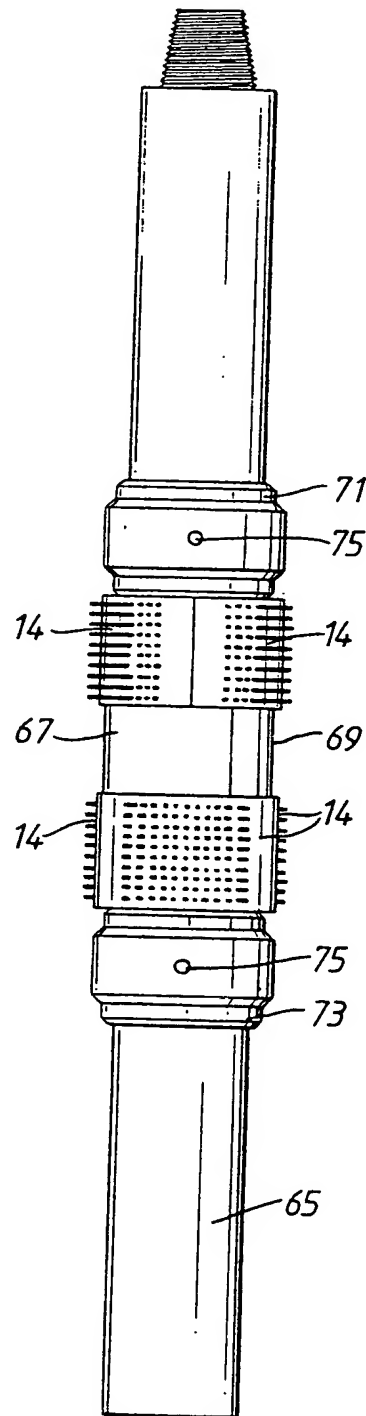


Fig.11

1     "Cleaning Apparatus"

2  
3     This invention relates to apparatus for cleaning the  
4     interior of a tubular member and especially, but not  
5     exclusively, for cleaning the inside of pipelines or  
6     oil, gas or water well tubulars, pipes or casings.

7  
8     Due to the operating conditions and environment, oil,  
9     gas and water well tubulars, pipes or casings require  
10    regular cleaning. Conventionally, cleaning the inner  
11    structure of a drill casing, pipe or tubing would  
12    involve utilising a casing scraper assembly, such as  
13    the Best (trade mark) oiltool casing scraper assembly.

14   ~~Such a conventional assembly incorporates steel casing~~  
15   scraper blades that scour the inside of the casing or  
16   tubing. Typically, each blade features several raised  
17   steel ribs that, once the scraper assembly has been  
18   lowered down the tubing or casing required to be  
19   cleaned, lie flush with the inner surface of said  
20   tubing or casing.

21  
22   Typically there are six scraper blades per scraper  
23   assembly, three upper scraper blades positioned 60°  
24   apart around the scraper assembly and three lower  
25   scraper blades that are positioned 60° apart and 60°

1 offset, when compared with the upper three scraper  
2 blades. Thus this conventional arrangement provides  
3 for a 360° cleaning capability of the assembly.

4  
5 A disadvantage of the conventional scraper blade is  
6 that the raised steel rib arrangement is not efficient  
7 since it requires considerable drill string movement to  
8 clean the specified portion of the inner structure of  
9 the tubing or casing, and it rapidly becomes less  
10 effective with wear.

11  
12 Another disadvantage of using conventional steel  
13 scraper assemblies is that, if they become dislodged  
14 from the scraper assembly apparatus, the cleaning  
15 operation must be stopped, the scraper assembly  
16 withdrawn and an attempt to retrieve the lost steel  
17 scraper must be initiated, which may take a long time.

18  
19 There are also safety implications if a conventional  
20 steel scraper blade becomes dislodged from the scraper  
21 assembly apparatus, on the basis that if the assembly  
22 apparatus is not stopped quickly, then the steel  
23 scraper blade will be free to impede the rotating  
24 string.

25  
26 The cleaning of pipelines may also present problems.

27  
28 A first aspect of the present invention provides  
29 apparatus for cleaning the interior of a tubular  
30 member, comprising a body member for insertion into the  
31 tubular member, and at least one cleaning pad mounted  
32 on the body member, the or each cleaning pad comprising  
33 a body having an inner face engaged with the body  
34 member and an outer face provided with protruding  
35 bristles, the or each cleaning pad being provided with  
36 a first edge in engagement with a recess in the body



1 member, and a second edge in engagement with a  
2 removable retaining device, such that removal of the  
3 retaining device permits removal of the or each  
4 cleaning pad from engagement with the body member.  
5  
6 Preferably, a plurality of cleaning pads are

---

1 circumferentially spaced around the body member.  
2 Typically, there is an upper row of three cleaning pads  
3 centred at 120° intervals, and a lower row of cleaning  
4 pads centred at 120° intervals and circumferentially  
5 offset with respect to the upper row.  
6

7 The body member may comprise part of a pipeline pig or  
8 be adapted to be coupled to a pipeline pig.

9 Alternatively, the body member may form a portion of a  
10 length of drillstring.  
11

12 The bristles may be of nylon. Alternatively, the  
13 bristles may be of wire, such as flame hardened steel  
14 or copper.  
15

16 In a particularly preferred feature of the invention,  
17 the cleaning pad is constructed to be drillable; that  
18 is to be capable of being readily cut by a rock drill  
19 bit.  
20

21 The body may be manufactured from a compressible  
22 material.  
23

24 The inner portion of the body may be arranged so that  
25 the body is compressible, the inner portion of the body  
26 preferably being arranged in a honeycomb structure to  
27 aid compressibility.  
28

29 The body may suitably be of a resin fibre compound,  
30 preferably a polyurethane fibre compound.  
31

32 The bristles may be mounted in a backing secured to the  
33 body, suitably by adhesive. The backing may be fabric  
34 into which the bristles are sewn or woven, or may be an  
35 elastomeric soft compound rubber material.  
36

1 Alternatively, the body may typically be manufactured  
2 from a malleable metal such as aluminium.

3  
4 Typically, the brush pads may be interchanged to  
5 different grades of bristle, to suit all types of  
6 cleaning environment.

7  
8 Preferably, the brush pads are held in place on the  
9 body member by a sleeve, the sleeve being run along the  
10 body member until it engages with the brush pad. More  
11 preferably, the sleeve is threaded and most preferably,  
12 the sleeve is provided with locking means for locking  
13 the sleeve with respect to the body member.

14  
15 The apparatus of the present invention may include a  
16 protection device comprising at least one protection  
17 pad, the or each protection pad being mounted on the  
18 body member and being constructed from a softer  
19 material than the tubular member.

20  
21 Preferably, a plurality of protection pads are  
22 circumferentially spaced around the body member.  
23 Typically there is an upper row of protection pads and  
24 ~~a lower row of protection pads.~~ Preferably the upper  
25 row of protection pads is above the uppermost row of  
26 cleaning pads and the lower row of protection pads is  
27 below the lowermost row of cleaning pads.

28  
29 The protection pads may be permanently secured to the  
30 body member.

31  
32 Alternatively the protection pads may be removable from  
33 the body member.

34  
35 The tubular member may be a pipeline or a tubular for  
36 insertion into a borehole, such as well casing or

1 tubing.

2

3 Examples of cleaning apparatus in accordance with the  
4 invention will now be described with reference to the  
5 accompanying drawings, in which:-

6

7 Fig. 1 is an exploded perspective view of a first  
8 example of well cleaning apparatus;

9 Fig. 2 is a perspective view showing the apparatus  
10 of Fig. 1 in assembled condition;

11 Fig. 3 is a front perspective view of a cleaning  
12 pad of the apparatus;

13 Fig. 4 is a rear perspective view of the cleaning  
14 pad;

15 Fig. 5 is a perspective of a second example of  
16 well cleaning apparatus;

17 Fig. 6 is a perspective view of a protection pad  
18 for use with the apparatus shown in Fig. 5;

19 Fig. 7 is a sectional view of a cleaning pad of  
20 the apparatus;

21 Fig. 8 is a perspective view of a first example  
22 of pipeline cleaning apparatus;

23 Fig. 9 is a perspective view of a second example  
24 of pipeline cleaning apparatus.

25 Fig. 10 is a sectional side view of a third  
26 example of pipeline cleaning apparatus; and

27 Fig. 11 is a side view of the apparatus shown in  
28 Fig. 10.

29

30 Referring to Figs. 1 and 2, a well cleaning apparatus  
31 comprises a mandrel 10 for inclusion in a drill string  
32 by means of a pin connector 12 and a box connector (not  
33 seen in the drawings) at the lower end.

34

35 The mandrel 10 carries six cleaning pads generally  
36 designated at 14. The cleaning pads 14 are arranged in

1 an upper row of three equally spaced around the  
2 circumference of the apparatus and a lower row of three  
3 equispaced pads offset from those of the upper row.  
4 The mandrel 10 has projecting formations providing  
5 upper and lower collars 16 and slots 19. Each cleaning  
6 pad 14 (see also Figs. 3 and 4) is formed with an upper  
7 lip 18, a lower lip 20, and angled side faces 22. Each  
8 pad 14 is secured in position on the mandrel by  
9 engaging one of the lips 18 and 20 underneath one of  
10 the collars 16 with the side faces 22 engaged in the  
11 slots 19. The inner ends of the pads 14 are then held  
12 in position by a two part collar assembly 24 secured  
13 together by screws 26. Each cleaning pad 14 is biased  
14 outwardly by a series of coil springs 28 each engaging  
15 in a corresponding bore 30 in the rear of the cleaning  
16 pad 14.

17  
18 Referring particularly to Figs. 3 and 4, each cleaning  
19 pad 14 comprises a body 32 having an arcuate front face  
20 34 and an arcuate rear face 36. Bristles 38 project  
21 from the front face 34 to provide, in use, a scrubbing  
22 action on the interior of the tubular being cleaned.  
23 In a preferred form, the bristles 38 are formed from  
24 flame hardened steel wire or copper wire and may  
25 suitably be 1/8" diameter set at 1/8" spacings.

26  
27 The body 32 is suitably a unitary moulding  
28 encapsulating a portion of each of the bristles 38 and  
29 is preferably moulded from a polyurethane fibre  
30 compound.

31  
32 In order to assist manufacture, the bristles 38 may be  
33 set in a sheet of textile or rubber material before  
34 being incorporated in the body 32.

35  
36 The cleaning pads 14 may readily be interchanged to

1 provide a suitable cleaning effect from any particular  
2 application. For example the pads 14 may be  
3 interchanged for pads having smaller diameter wire  
4 bristles or nylon bristles.

5  
6 The cleaning pads 14 may be constructed from a  
7 compressible material and further may have a honeycomb-  
8 like centre 25, to aid compressibility, as can be seen  
9 in Fig. 7.

10  
11 In the event that one or more of the cleaning pads 14  
12 becomes dislodged from the mandrel 10, the nature of  
13 its construction is such that it is readily drilled  
14 through by a drill bit or other implement commonly used  
15 in a well tubular, since the polyurethane body is  
16 relatively easily drilled away leaving relatively small  
17 pieces of wire which can be handled in a manner similar  
18 to drill chippings.

19  
20 The well tubing may change direction by a relatively  
21 high degree, thus requiring the drillstring to navigate  
22 this change in direction if, for instance, the  
23 drillstring is being run in or pulled out of the well  
24 tubing.

25  
26 Fig. 5 shows a second example of well cleaning  
27 apparatus with protection pads 50 mounted on the  
28 mandrel 10 and arranged in an upper row and a lower  
29 row. The upper row of protection pads 50 are located  
30 above the upper row of cleaning pads 14, and the lower  
31 row of protection pads 50 are located below the lower  
32 row of cleaning pads 14. The protection pads 50  
33 project outward from the mandrel 10 by a sufficient  
34 length so that if the mandrel 10 navigates a change in  
35 direction of the well tubing, the protection pads 50  
36 are substantially the point of contact between the

mandrel 10 and the well tubing. As the protection pads 50 are constructed from a softer material than the well tubing, the protection pads 50 are sacrificed in order to protect both the mandrel 10, the cleaning pads 14 and the well tubing. An individual protection pad 50 is shown in Fig. 6.

Fig. 8 shows a first example of pipeline cleaning apparatus, wherein a pig 55, 60 is run into a pipeline 53 that requires to be cleaned. Conventionally, the pig 55, 60 has a first module 55, and a second module 60 and is run into the pipeline 53 by means of a fluid pressure that is built up behind the second module 60. Cleaning pads 14 can be mounted around the circumference of either the first module 55 or the second module 60. In Fig. 8 the cleaning pads 14 are mounted around the circumference of the second module 60. The cleaning pads 14 can be biased outwardly by a series of coil springs (not shown) as in the embodiment shown in Fig. 1.

Fig. 9 shows a second example of pipeline cleaning apparatus, wherein the cleaning pads 14 are mounted on a suitable body 62, which is connected to the second module 60 of the pig. Thus, the body 62 follows the pig down the pipeline 53 requiring to be cleaned.

Fig. 10 and Fig. 11 show a third example of pipeline cleaning apparatus, wherein the cleaning pads 14 are mounted on a body 65. One end of the cleaning pad 14 is held in place on the body 65 by two half shells 67, 69, which are welded together around the body 65. The other end of the cleaning pad 14 is held in place by a stabilizer sleeve 71, 73, each of which is threaded onto the body. When the stabilizer sleeves 71, 73 have been threaded onto the body 65 to the desired position,

1 the stabilizer sleeves 71, 73 are locked in position by  
2 a locking nut 75 which engages a recess in the body 65,  
3 and hence the stabilizer sleeves 71, 73 are locked with  
4 respect to the body 65.

5

6 Modifications may be made to the foregoing within the  
7 scope of the present invention.



1     Claims

2  
3     1.   Apparatus for cleaning the interior of a tubular  
4     member, comprising a body member for insertion into the  
5     tubular member, and at least one cleaning pad mounted  
6     on the body member, the or each cleaning pad comprising  
7     a body having an inner face engaged with the body  
8     member and an outer face provided with protruding  
9     bristles, the or each cleaning pad being provided with  
10    a first edge in engagement with a recess in the body  
11    member, and a second edge in engagement with a  
12    removable retaining device, such that removal of the  
13    retaining device permits removal of the or each  
14    cleaning pad from engagement with the body member.

15  
16    2.   Apparatus according to Claim 1, wherein a  
17    plurality of cleaning pads are circumferentially spaced  
18    around the body member.

19  
20    3.   Apparatus according to Claim 2, wherein there is  
21    an upper row of three cleaning pads centred at 120°  
22    intervals, and a lower row of cleaning pads centred at  
23    120° intervals and circumferentially offset with  
24    respect to the upper row.

---

25  
26    4.   Apparatus according to any of the preceding  
27    claims, wherein the bristles are nylon bristles.

28  
29    5.   Apparatus according to any of Claims 1, 2 or 3,  
30    wherein the bristles are hardened metal wire bristles.

31  
32    6.   Apparatus according to any of the preceding  
33    Claims, wherein the cleaning pad body is constructed  
34    from a drillable material.

35  
36    7.   Apparatus according to Claim 6, wherein the

1 cleaning pad body is constructed from a resin fibre  
2 compound.

3

4 8. Apparatus according to Claim 6, wherein the  
5 cleaning pad body is manufactured from a malleable  
6 metal.

7

8 9. Apparatus according to any of the preceding  
9 Claims, wherein the cleaning pad body is compressible.

10

11 10. Apparatus according to any of the preceding  
12 Claims, further comprising at least one protection pad  
13 mounted on the body member, the protection pad being  
14 manufactured from a softer material than the tubular  
15 member material.

16

17 11. Apparatus according to Claim 10, wherein a  
18 plurality of protection pads are circumferentially  
19 spaced around the body member.

20

21 12. Apparatus according to Claim 11, wherein there is  
22 an upper row of protection pads and a lower row of  
23 protection pads, where the upper row of protection pads  
24 are located above the upper row of cleaning pads and  
25 the lower row of protection pads are located below the  
26 lower row of cleaning pads.

27

28 13. Apparatus according to any of the preceding  
29 Claims, wherein a first end of the cleaning pad is  
30 mounted on the body member by a fixed collar, and a  
31 second end of the cleaning pad is mounted on the body  
32 member by a moveable sleeve.

33